

Serious Games: Use and Perceptions of Secondary Education Teachers in Greece

Vasiliki Loli^{1,*}, Eleni Vlachou^{1,2}, and Ioannis Karydis¹

ABSTRACT

This paper investigates the use and perception of serious games among secondary education teachers in Greece. A structured online questionnaire assessed the impact of prior experience on teachers' attitudes. Results indicate that 44.8% of respondents have integrated serious games into their teaching, with most recognizing their value as motivational, collaborative, and instructional tools. Teachers with prior experience using serious games demonstrated significantly more positive attitudes than those without. Independent t-tests confirmed statistically significant differences in perceptions between the two groups. These findings highlight the potential of serious games in secondary education and underscore the importance of teacher experience in their acceptance and implementation.

Keywords: Motivation, secondary education teachers, serious games, teachers' perceptions.

Submitted: December 23, 2025

Published: December 31, 2025

 10.24018/ejeng.2026.1.CIE.70023

¹ Department of Informatics, Ionian University, Greece.

² Creative Web Applications P.C., Greece.

* Corresponding Author:
e-mail: vaswliwli@gmail.com

1. INTRODUCTION

Digital games, or video games in general, have long been a significant part of people's lives, serving as a fully-fledged entertainment medium, with an annual turnover of several billion dollars and continuous technological advancements [1]. According to Esposito [2]: "A video game is a game which we play thanks to an audiovisual apparatus and which can be based on a story," which is a simple but yet comprehensive definition, based on well-known terms; game, play, interactivity, and narrative. Conventional video games are developed with the sole purpose of entertaining their users, however there are instances of games that manage to achieve additional purposes, such as passing on historical knowledge [3].

Serious Games, on the other hand, are most commonly referred to as digital games designed to serve, some would argue, a higher purpose beyond mere entertainment, enjoyment, or fun, according to Laamarti *et al.* [4]. The general concept of Serious Game and the foundation for some of its modern ideas, is said to have been established in 1970 by Clark C. Abt in his book titled "Serious Games" [5].

These games can be used in various domains including, but not limited to, games for education, training, healthcare, cultural heritage, advertisement, and interpersonal communication [4]. Some notable examples of such games are the following: the wide release of America's Army game in 2002 [6], the educational version of Minecraft, Minecraft Education, released in 2016 [7], and the first-ever Food and

Drug Administration (FDA)-approved game for attention deficit hyperactivity disorder (ADHD) in young children, EndeavorRx, released in 2020 [8].

Motivation is a key factor in the success of Serious Games, by encouraging individuals to achieve goals and gain knowledge [9]. Within the learning framework, motivation functions in two ways: externally, through outside influences, and internally, through personal drive, both of which are essential for active participation in learning [9]. According to the "Flow Theory," this engagement is maximised when an individual's skills match the challenge level, leading to deep focus and intrinsic motivation, where the activity itself becomes the primary source of enjoyment [9]. Thus, by leveraging motivation through the innovative experiences of Serious Games, the user is able to obtain information, training, and engagement, beyond the traditional gaming.

1.1. Motivation and Contribution

This study examines Serious Games, with an emphasis on their applications, psychological impact—particularly in relation to motivation and flow theory—and their role in education. A literature review provides context, while a survey on secondary education teachers in Greece explores their use and perceptions of these games in the classroom.

The motivation for this research stems from the increasing global emphasis on innovative teaching methods, such as game-based learning, and the lack of sufficient studies



exploring how these methods are perceived and implemented in the contemporary Greek educational system. This gap highlights the need to examine the attitudes, experiences, and challenges faced by secondary education teachers in Greece, in order to better understand how such methods can be integrated into their teaching practices and how their attitudes are influenced by certain factors.

Given the limited research on this topic in Greece, the study's contributions offer valuable insights into:

1. The use of Serious Games in the classroom by secondary education teachers in Greece.
2. The attitudes of secondary education teachers in Greece towards the use of Serious Games in the classroom.
3. Differences in perspectives between teachers with prior experience of integrating Serious Games into their teaching and those without prior experience.

The rest of this paper is organised as follows. Section II covers the wide range of serious games' categories and their application fields, the integration of serious games in the educational sector and finally the role of motivation and flow theory in the effectiveness of these games. Section III describes the methodology used to conduct the literature review for the related research findings included in Section II, outlining the source search process, the search methodology, and the inclusion and evaluation criteria that were utilised. Section IV presents the research that was conducted through a questionnaire on secondary education teachers in Greece regarding the topic of serious games, explaining the purpose of the research and the availability of related studies, the design of the questionnaire and the results of it. Finally, Section V outlines the key conclusions drawn from the study.

2. RELATED RESEARCH

2.1. Categories of Serious Games

Conventional digital games, and by extension Serious Games, are characterised by certain properties or features, which make up, collectively, distinct categories. These features are often displayed in the form of tags, a practice commonly seen on well-known game distribution and hosting platforms, such as Valve Corporation's Steam, to facilitate easier navigation and categorization. Breuer and Bente [10] propose their approach on the classification/categorization of Serious Games, which is based on the use of the labelling system similar to the one widely used today for conventional digital games. The proposed [10] labels/ tags consist of [10]: platform, subject matter, learning goals, learning principles, target audience, interaction mode(s), application area, controls/ interfaces, common gaming labels.

Serious Games are applied in a wide range of fields, each with their own specific goals and contexts. These include, but are not limited to, games for education, training, healthcare/medicine, well-being, corporate games, advertising, military/defence, government, social awareness, and cultural heritage [11].

Health-related Serious Games follow two main directions: the first, known as exergames, promotes healthier

lifestyles by encouraging physical activity through digital games, whereas the second focuses on healthcare applications such as health monitoring, diagnosis and treatment, prevention, and rehabilitation [4]. These games are also used to educate and train health professionals across various fields, including surgery, odontology, nursing, cardiology, first aid, dietician and diabetes, and psychology [12]. When it comes to corporate related games, Serious Games are employed in three primary domains: training, recruitment, and marketing & sales [13]. These games facilitate employee development across various stages—from recruitment to leadership—by providing a safe, failure-free environment for skill-building in areas such as finance, business, hospitality, sales orientation, and networking. In recruitment and marketing contexts, they can support decision-making processes related to hiring and serve as innovative tools for promoting products or services, known as advergaming [13]. In the military domain, Serious Games integrate simulation systems, game technologies, and existing training tools to support scenario-based training, case mapping, real-time monitoring, environment-specific camouflage, and key simulation functions such as movement and perception, as proposed by Yildirim [14]. They also incorporate graphical interfaces, physical models, and social aspects of operational areas to enhance training effectiveness [14]. In the cultural domain, Serious Games help preserve and promote both tangible and intangible heritage—ranging from buildings and artworks to customs, beliefs, and language [15]. Mortara *et al.* [15] categorise them into cultural awareness (intangible heritage), historical reconstruction (specific events), and heritage awareness (realistic site recreations).

2.2. Serious Games in Education

Use of technology is not only a daily habit but also a necessity, especially for the new generation of students or learners in general, whose learning demands and ways of thinking are deeply shaped by the technological era and differ significantly from those of previous generations [16]. In response to these evolving needs, regardless of educational level, Serious Games (or Digital Game-Based Learning) are increasingly used as digital tools across a wide range of subjects. This approach effectively captures students' interest by leveraging the appeal and engaging nature of video games [4]. According to Perrotta [17], game-based learning is “a form of experiential engagement in which people learn by trial and error, by role-playing and by treating a certain topic not as ‘content’ but as a set of rules, or a system of choices and consequences.”

It is crucial to consider learners' perceptions of serious games as an alternative teaching method. Research by Zhonggen [18] indicates that learners generally display positive attitudes, positive cognitive perceptions, and high positive and low negative affective perceptions towards assisted learning through the use of serious games. A key factor contributing to the positive reception of serious games is their compatibility with mobile devices, which learners use daily. This accessibility, combined with the convenience and portability of mobile technology, makes learning more appealing and engaging for learners, reinforcing the effectiveness of serious games in both formal and informal educational settings.

Serious games and digital game-based learning offer a wide range of benefits that enhance educational practices and positively influence modern life [16]. As Anastasiadis *et al.* [16] note through their research, numerous studies in recent years have emphasised the advantages of these games in the educational sector, particularly their ability to increase student motivation, engagement, and learning efficiency. These games create an enjoyable and appealing learning environment, encouraging active participation. Moreover, they can support cognitive development, digital literacy, social-emotional growth, and soft skills' development. They also strengthen critical thinking, decision-making, and problem-solving skills, while fostering collaboration, communication, autonomy, and a healthy sense of competition. The rewarding nature of game progression and feedback-driven, student-centred learning structure further enhances the educational experience.

An example of educational serious games is Minecraft's Education Edition, based on the popular sandbox game Minecraft, which is frequently used in elementary schools to teach subjects that include technology, art & design, math & economics, science, history, geography, computer science, reading & writing, climate & environment, and gaming [7]. This game includes both pre-made and customizable lessons tailored to each classroom's needs, hence the extensive coverage of a wide variety of subjects.

Other educational serious games are designed with a specific focus or subject. Such an example is ARIN-561, which introduces high school students to classical search algorithms (e.g., Breadth First Search, Greedy Search, etc.), using them to teach core AI concepts like time and space complexity [19]. By linking familiar math knowledge to algorithmic analysis, the game helps students evaluate AI methods as they progress through learning objectives. In other cases, games aim to educate players on societal issues. For instance, the Greek game MAtHE [20] was developed to address the spread of misinformation on the web. It tasks players with verifying real or fake news articles using tools like search engines, reverse image search, and debunking websites, effectively promoting digital literacy and critical thinking [20].

2.3. The Role of Motivation

Motivation plays a critical role in the effectiveness of serious games, serving as a key element in attracting, engaging, and retaining users to achieve educational or behavioural outcomes. It is influenced by personal desires, expectations, self-efficacy, and social reinforcement [9]. Locke and Schattke [21] categorize motivation into three types: intrinsic, extrinsic, and achievement motivation. Intrinsic motivation involves engaging in an activity for its own sake, where enjoyment comes from the activity itself rather than any external reward. In contrast, extrinsic motivation is driven by outcomes, such as earning a high score or recognition for performance [21], [22]. Achievement motivation, on the other hand, refers to an individual's drive to improve or compete, often without deriving enjoyment from the activity itself [21].

Designing effective serious games requires a strategic combination of these different types of motivation drives.

Drummond *et al.* [22] highlight the importance of a good balance between both intrinsic and extrinsic motivation in order to keep players engaged. However, considering the research done by Locke and Schattke [21], and the existence of three types of motivation, it is important to recognize achievement motivation as a distinct type, as it is often mistakenly overlooked or confused with intrinsic motivation. When combined, these motivational types can induce a state of "flow," a deep, immersive mental state characterised by intense focus and full absorption in the activity at hand [23]. This phenomenon, strongly linked to enhanced learning and performance, represents a core objective in the design of impactful serious educational games [24].

In order to achieve the aforementioned state of flow, two key conditions must be present: an optimal balance between the challenge of the task and the individual's skill level, and the presence of clear goals with immediate feedback [25]. According to Nakamura and Csikszentmihalyi [25], individuals in this state exhibit several distinct characteristics, including deep concentration on the task, a merging of action and awareness, diminished self-consciousness, a strong sense of control, and a distorted perception of time. The activity itself becomes intrinsically rewarding, rendering the end goal secondary to the immersive experience.

3. METHODOLOGY

3.1. Source Search

The process of searching for bibliographic sources was conducted through the Google Scholar search engine in academic journals and books, as well as through partial search in the bibliography of some key papers. The search primarily focused on relatively recently published sources between 2015 and 2024, i.e., approximately the last ten years. However, earlier published sources were also considered into the source selection, if deemed necessary for the purpose of gathering specific information or for studying and documenting historical milestones from classical works [26], [27].

3.2. Search Methodology

The literature review primarily aimed to collect and document information on the topic of Serious Games, focusing on the aspects of their categorization, their significant role in education and how they have been used in practice. In addition, the importance of the individual's psychological role in these games was addressed, with particular emphasis on motivation. The objectives of the literature review are also presented in order to contextualize the search methodology that follows.

To ensure alignment with the literature review objectives, a structured search strategy based on key words relevant to each objective was conducted, as per [27]. The initial phase focused on key terms such as: "digital games," "serious games," "serious games overview," and "history of serious games," in order to establish a foundational understanding of the field. This was then complemented by a more focused search, using keywords such as: "serious games

definition,” to clarify key terminology. In addressing categorization and practical applications of serious games, there was used of search key phrases such as: “serious games in [application field],” filled accordingly by each selected category: “education,” “healthcare,” “corporate,” and “military.” Additionally, individual searches were conducted for some selected games identified through earlier stages, enabling a closer examination of their practical use. Finally, to explore the underlying role of psychology, motivation and flow theory in Serious Games, key terms such as: “psychology in serious games,” “motivation in serious games,” and “flow theory” were utilised.

3.3. Inclusion and Evaluation Criteria

The literature review revealed the growing importance and wide applicability of Serious Games in education, emphasising their motivational, instructional, and collaborative benefits [16], [18]. However, it also highlighted certain gaps, particularly in the Greek context. While many international studies focus on primary education or university-level learners, there is a notable scarcity of empirical research investigating how secondary education teachers in Greece perceive and use Serious Games [28]–[30].

Moreover, the existing literature often examines general benefits and theoretical frameworks without addressing the practical challenges teachers face in integrating these tools into their classrooms. It also lacks a clear understanding of how prior experience with Serious Games influences teachers’ attitudes and acceptance of such tools.

To address these gaps, this study developed and distributed a structured questionnaire targeting active secondary school teachers in Greece. The aim was to explore their familiarity with Serious Games, actual usage in teaching, perceived benefits and concerns, and how prior experience shapes these perceptions.

Given the extensive literature on the wide topic of serious games with 3.620.000 results on Google Scholar, specific inclusion criteria were established to guide the selection of relevant publications. These criteria include a high citation count—though exceptions may be made in certain cases—the availability of the publication in English, the presence of experimental or empirical research when the publication is about a specific game, and the availability of reported results, again as per Van Wee and Banister [27].

Subsequently, a review of the publications was conducted to identify those that contain the relevant information. For articles, this involved reading the abstract, introduction, or conclusions, examining sub-sections, and searching for keywords [31]. When the source involved a book, the process included examining the cover page, reading the table of contents and sub-chapters, and using the index to check for key words [31].

The process for evaluating sources used is called A.S.A.P. by IRIS [32]. According to the A.S.A.P. method the acronym and the criteria applied, as per Clark University [32]:

A is for the author: assess the credibility of the author/authors when available information is provided.

S is for Sources: Check for the presence of a reference list in the publication and evaluate the quality and quantity of the sources.

A is for Age: Verify the publication date of the source.

P is for Publisher: Assess the credibility of the publisher.

More detailed information about each criterion is provided on Clark College Libraries’ website¹ about A.S.A.P. evaluation method [32].

4. EXPERIMENTAL EVALUATION

4.1. Purpose of the Present Research and Related Studies

Building upon the findings of the literature review, which identified both the potential and challenges of using Serious Games in educational settings [18], [28], this section presents the design and implementation of an empirical study aimed at secondary education teachers in Greece. Given the limited national research and the highlighted gap in understanding teachers’ practical engagement with Serious Games, the present study employed a structured questionnaire to gather data on their awareness, attitudes, usage patterns, perceived benefits, and potential concerns. Special attention was paid to the role of prior experience in shaping these perceptions.

A search was conducted in order to find similar studies revealing a lack of research, specifically addressing secondary education teachers in Greece on the topic of Serious Games. As Pinnikas notes [28], studies targeting educators in Greece regarding Serious Games are scarce. A relevant study is that of Alexandri’s doctoral dissertation [29], which examines secondary teachers’ views on ICT (Information and Communication Technology) and their attitudes towards digital educational games. Pinnikas in his master’s thesis [28], studied both primary and secondary educators, focusing on the barriers they encounter with such games. Another related study is that of Megagianni and Kakana [30], which involves primary school teachers and investigates their views on Serious Games, their educational value, and their impact on children’s cognitive, social, and emotional development, along with the role of teachers’ age and digital literacy.

4.2. Questionnaire Design

For the purpose of data collection in this research, a structured questionnaire was developed and administered. It consists entirely of close-ended questions, except for one open-ended question. This method was selected due to the several advantages it presents: it is well-suited for gathering information from a large sample, minimizes the potential for researcher bias, and allows for relatively straightforward assessment of its reliability and validity [33]. The questionnaire, as shown in Fig. 1, was created using the Google Forms platform and includes an introductory page followed by six sections of questions. It was distributed via email.

The introductory page, presented first to participants, outlined the research purpose and emphasised the importance of anonymity. A definition of Serious Games was

¹ <https://clark.libguides.com/tutorials-home/asap>

How often do you use a serious game for teaching a lesson in the classroom? *

☐ Never

☐ Less than once a year

☐ A few times a year

☐ A few times a month

☐ A few times a week

Are there available facilities at your school to support teaching with the use of serious games *
(e.g. a computer lab or access to computers in the classroom)?

☐ Yes

☐ No

Fig. 1. Snapshot of questionnaire.

also provided, highlighting their educational role within the context of the study to ensure clarity for those unfamiliar with the term. This definition was reiterated later in the survey to account for the possibility that participants may have overlooked it initially.

The first section gathered demographic data, including participants' age and gender, in the form of multiple-choice questions. Additionally, they were asked about the subjects they currently teach, in the form of checkboxes, and their years of service in the educational sector, in the form of multiple-choice intervals, adapted from Noraddin and Kian [34].

The second section assessed teachers' familiarity with and use of technology. Three questions, adapted from Son *et al.* [35], measured familiarity with computers, the internet, and digital technologies using a 5-point Likert scale [36]. Two additional questions evaluated ICT use in the classroom and daily device use, again via a 5-point Likert frequency scale [36]. The final three questions, based on Assaf *et al.* [37] examined personal gaming habits: frequency of play (5-point Likert frequency scale), preferred devices, and game types, the latter two using multiple-choice questions.

The third section introduced the concept of Serious Games and began with a reminder of the definition. The first two dichotomous [36] questions assessed participants' familiarity with the terms "Serious Games" and "digital educational games," as previous studies indicated limited awareness among respondents [37], [38]. Two further dichotomous questions examined the use of Serious Games in daily life and in the classroom. Frequency of use in the classroom was assessed with a 5-point Likert frequency scale adapted from Megagianni and Kakana [30]. Two additional dichotomous questions investigated the presence of suitable infrastructure and access to it for educational use in each setting. The final question in this section asked teachers to select which school subjects they considered most appropriate for the use of Serious Games, using a multiple-choice format.

The fourth section examined teachers' attitudes towards using Serious Games in education. The first question included four statements, adapted from An and Cao [39], evaluating general attitudes on a 5-point Likert scale. The second question, adapted from Noraddin and Kian [34], presented ten statements outlining reasons for using Serious Games, categorised as motivational, collaborative, and instructional tools. The final question focused on concerns teachers may have regarding the integration of Serious Games, using statements adapted from An and Cao [39], all rated on a 5-point Likert scale.

The fifth section contained a single question addressing the perceived educational benefits of using Serious Games. Statements 1-8 were adapted from An and Cao [39], whereas statements 9-10 were drawn from Ouahbi *et al.* [38]. All statements were rated on a 5-point Likert scale.

The sixth and final section gathered teachers' concluding thoughts through two questions. The first examined whether Greek people are open to using alternative learning tools like Serious Games, referring broadly to teachers, students, parents, and other related stakeholders. As Athanasopoulos [40] noted, challenges in Greece include infrastructure limitations, teachers' and parents' concerns, as well as students' lack of familiarity with such methods. The second, open-ended question invited participants to openly share their views and thoughts on the use of Serious Games in the Greek education system.

4.3. Results

4.3.1. Participants

A key criterion for participhe secondary education sector, with no restriction regarding their area of specialization. Recruitment was done by distributing the questionnaire via email to selected secondary schools in Greece, in order to ensure their active role in education.

The participants in this study consisted of a total number of 105 individuals ($N = 105$), where 78% ($n = 82$) are female and 22% ($n = 23$) are male. All age groups

TABLE I: TEACHERS' AGE GROUP

25–34	35–44	45–54	55+
2.9%	20%	33.3%	43.8%

TABLE II: TEACHERS' YEARS OF SERVICE

1–5	6–10	11–15	15+
16.2%	6.7%	6.7%	70.5%

TABLE III: TEACHERS' DIGITAL LITERACY

	Mean	Standard deviation
Computer familiarity	4.50	0.65
Internet familiarity	4.51	0.64
Digital technology familiarity	4.19	0.82

were covered, as shown in Table I, with highest observed participation being the age group of 55 and above with 43.8% (n = 46). This aligned with findings from Lakasas [41] reporting that the majority of active secondary education teachers in Greece are aged 50 and above [41]. The 45–54 age group comprises 33.3% (n = 35) of participants, the 35–44 group accounts for 20% (n = 21), and the 25–34 group represents only 2.9% (n = 3). Thus, the majority of participants belong to what Prensky [42] describes as the “digital immigrant” generation, individuals not born into the digital era.

Regarding years of service, as shown in Table II, most participants (70.5%, n = 74) had over 15 years of teaching experience, while 29.5% (n = 31) had less. Specifically, 6.7% (n = 7) had worked for 11–15 years, 6.7% (n = 7) for 6–10 years, and 16.2% (n = 17) for 1–5 years. As noted by Noraddin and Kian [34], such extensive experience enables participants to offer well-informed perspectives.

The participants in this study reported teaching a variety of subjects, with modern Greek language being the most commonly taught subject, representing 21.6% of the sample (n = 28). Physics, mathematics, and foreign languages were each taught by 10.6% of participants (n = 14). Other subjects such as biology (6.8%, n = 9), informatics (6.1%, n = 8), chemistry (5.3%, n = 7), and history (4.5%, n = 6) were less frequent. The remaining participants (n=35) covered a diverse range of general and special education subjects, each constituting smaller percentages of the sample.

Teachers' digital literacy was self-assessed using a relevant tool, yielding a high average score (M = 4.4, SD = 0.72) on a 5-point Likert scale, where M denotes the mean and SD the standard deviation. Among the three items, familiarity was highest with the Internet (M = 4.51, SD = 0.64), followed by computers (M = 4.5, SD = 0.65), and digital technology (M = 4.19, SD = 0.82). The results are shown in Table III.

4.3.2. Habits of Participating Teachers

Teachers were asked about their use of electronic devices (e.g., computers, mobile phones, etc.) in daily life and in the classroom, as well as their digital gaming habits. Most reported using ICT in the classroom with varying frequency, as shown in Table IV: 28.6% (n = 30) several times a week, 26.7% (n = 28) daily, and 26.7% (n = 28) several times a month. Less frequent use was reported by 12.4% (n = 13) using it less than once a month, and 5.7% (n = 6) rarely or never. Overall, the data indicate that most teachers in the sample use ICT regularly in their classrooms.

Most teachers (95.2%, n = 100) use electronic devices daily, though the majority (67.6%, n = 71) rarely or never play digital games. Among those who do, mobile phones are the preferred device (35.2%, n = 37), and puzzle and strategy games are the most common genres. Nearly half (44%, n = 46) report not playing any games at all.

4.3.3. Use of Serious Games

Before being introduced in the questionnaire with the term of Serious Games, 75.2% (n = 79) of teachers were unfamiliar with it, whereas 89.5% (n=94) recognised the term digital educational games, as shown in Table V. This suggests limited awareness of Serious Games among Greek educators, consistent with the international findings [37], [38].

After being informed of the term, 44.8% (n = 47) reported having played a Serious Game in their personal lives. Regarding the use of such games in the classroom, the percentage remains low, with 44.8% (n = 47) of teachers reporting they have used them, as shown in Table VI. The frequency of Serious Games usage in classrooms remains low, with just 3.8% (n = 4) reported using them weekly, 10.5% (n = 11) a few times a month, 23.8% (n = 25) a few times a year, and 11.4% (n = 12) less than once a year. Notably, 50.5% (n = 53) never use them at all. Still, 81% (n = 85) of participating teachers reported their schools have the infrastructure to support the usage of Serious Games, while 74.3% (n = 78) reported to have access to this infrastructure.

The use of Serious Games in the classroom was examined to determine whether it is influenced by teachers' age group, using the chi-square test. The results showed that age did not significantly impact the use of Serious Games ($\chi^2(3) = 0.756$, $p = 0.86$). The chi-square test is used to assess the independence between two categorical variables [43]. Based on these results, the variables are independent of each other.

Teachers identified the most suitable subjects for Serious Games as Information Technology (53.3%, n = 56), Foreign Languages (48.6%, n = 51), Mathematics (46.7%, n = 49), Modern Greek Language (44.8%, n = 47), Physics (43.8%, n = 46), and Biology and Chemistry (41%, n = 43). Other subjects mentioned include History, Ancient Greek,

TABLE IV: USE OF ICT IN CLASSROOM BY TEACHERS

Rarely or never	Less than once a month	A few times a month	A few times a week	Everyday
5.7%	12.4%	26.7%	28.6%	26.7%

TABLE V: TEACHERS' FAMILIARITY WITH TERMS

Term	Familiar	Not familiar
Serious games	75.2%	24.8%
Educational digital games	89.5%	10.5%

TABLE VI: SERIOUS GAMES USE FREQUENCY IN THE CLASSROOM

Never	Less than once a month	A few times a year	A few times a month	A few times a week
50.5%	11.4%	23.8%	10.5%	3.8%

Religious Studies, Economics, Geography, and Gardening. Interestingly, 5.7% ($n = 6$) believe all subjects are suitable, while one educator ($n = 1$) disagrees, stating no subject is suitable. Additionally, 2% ($n = 2$) were unsure.

4.3.4. Attitudes of Teachers Towards Serious Games

On a 5-point Likert scale (1 = strong disagreement, 5 = strong agreement), teachers demonstrated a generally positive attitude towards the use of Serious Games in the classroom, with a mean score of 3.8 ($M = 3.8$, $SD = 0.86$), indicating a clear tendency towards agreement. Regarding their enthusiasm for incorporating these games into their teaching, the mean score was 3.4 ($M = 4.3$, $SD = 0.93$), suggesting moderate agreement. Teachers also reported a mean score of 3.3 ($M = 3.3$, $SD = 0.98$) in terms of comfort with handling these games. A low mean score of 1.9 ($M = 1.9$, $SD = 1.01$) regarding opposition to these games, suggests that most teachers are not against using them, indicating overall support.

4.3.5. Reasons for Using Serious Games

On a 5-point Likert scale (1 = strong disagreement, 5 = strong agreement), teachers rated the use of Serious Games as a motivational tool highest ($M = 3.93$, $SD = 0.81$), followed by their use as an instructional tool ($M = 3.81$, $SD = 0.82$), and as a collaboration tool ($M = 3.73$, $SD = 0.85$). These categories, based on Noraddin and Kian's framework [34], reflect a generally positive attitude among teachers towards the various educational uses of Serious Games. Results are shown in Table VII.

4.3.6. Teachers' Concerns Regarding Serious Games

Teachers reported relatively low levels of concern regarding the use of Serious Games in the classroom, with an overall mean score of 2.15 ($M = 2.15$, $SD = 0.68$) on a 5-point Likert scale (1 = strong disagreement, 5 = strong agreement), indicating general disagreement with concern-related statements. The highest-rated concern was that Serious Games may capture attention without aiding knowledge acquisition ($M = 2.28$, $SD = 0.63$), though

TABLE VII: REASONS FOR USING SERIOUS GAMES IN CLASSROOM

	Mean	Standard deviation
Motivational tool	3.93	0.81
Collaborative tool	3.73	0.85
Instructional tool	3.81	0.82

this score remains low. Concerns about their inefficacy with complex content ($M = 2.20$, $SD = 0.67$), potential distraction ($M = 2.18$, $SD = 0.68$), and fear of criticism ($M = 2.18$, $SD = 0.68$) were similarly minor. The lowest concern was that Serious Games might be a waste of time ($M = 1.91$, $SD = 0.68$).

However, some teachers expressed concerns in the open-ended question included in the questionnaire. Several emphasised that Serious Games should not replace traditional teaching methods but rather complement them and should be used with care and discretion. Others raised issues related to the potentially addictive nature of games, highlighting risks such as reduced attention spans and the passive reception of ready-made knowledge.

4.3.7. Educational Benefits of Serious Games

Teachers' perceptions of the educational benefits of Serious Games were assessed using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Overall, responses were positive ($M = 3.88$, $SD = 0.94$), and individual benefits scores are shown in Table VIII.

Some teachers highlighted additional benefits of Serious Games, noting their ability to engage more reserved students and enhance interactivity. One teacher mentioned using them to review knowledge and stimulate recall, thought, and creativity.

4.3.8. Greeks Receptiveness Towards Serious Games

Teachers were asked to assess how receptive the Greek community is to alternative educational tools, such as Serious Games. The average score was 3.22 ($M = 3.22$, $SD = 0.90$), indicating a generally moderate, slightly positive perception. Most teachers (38.1%, $n = 40$) believe them to be moderately receptive, while an equal percentage view it as fairly receptive. Meanwhile, 16.2% ($n = 17$) believe the community shows minimal receptiveness, and only 3.8% ($n = 4$) each believed them to be either not receptive at all or very receptive.

Despite the Greek public's general receptiveness to the use of Serious Educational Games, this alone is insufficient to ensure their effective integration into schools. Teachers, parents, and students may be relatively open to the idea, but several educators have anecdotally emphasised that Greek schools are often not adequately equipped to support such tools in practice. For successful implementation, both schools and teachers must receive appropriate training and information, alongside a genuine willingness from

TABLE VIII: EDUCATIONAL BENEFITS OF SERIOUS GAMES

Educational benefits	Mean	Standard deviation
Increased learning motivation	3.87	1.00
Support for learning	3.95	0.89
Student collaboration	3.86	0.85
Modern skill development	3.97	0.97
Problem-solving skills	3.89	0.92
Personalised teaching	3.75	1.01
Addressing diverse student needs	3.79	0.92
Engaging learning through fun	4.00	0.92
Imagination development	3.90	1.00
Communication skills	3.79	0.92

TABLE IX: T-TEST ANALYSIS OF REASONS FOR USING SERIOUS GAMES BY PRIOR CLASSROOM EXPERIENCE

Experience with using SGs	M (Yes)	SD (Yes)	M (No)	SD (No)	T	P
Motivational tool	4.15	0.67	3.75	0.66	3.09	0.003*
Collaborative tool	3.90	0.85	3.59	0.70	2.04	0.041*
Instructional tool	4.01	0.69	3.66	0.65	2.71	0.008*

Level of significance: $P < 0.05$.

educators to engage with these digital resources. Furthermore, the use of Serious Games must be aligned with the national curriculum to be both practical and pedagogically relevant.

4.3.9. Teachers' Attitudes Towards Using Serious Games in the Classroom and Their Prior Integration Experience

Independent samples t-test [44] was conducted to examine the potential influence of teachers' attitudes towards the use of Serious Games in the classroom, comparing the group with prior experience with them to the group with no experience. Initially, it was examined whether prior use of Serious Games influences teachers' willingness or enthusiasm to use them. The results indicated a statistically significant difference between experienced ($M = 3.98$, $SD = 0.71$) and inexperienced teachers ($M = 3.23$, $SD = 0.83$), with a mean difference of 0.75 ($t(103) = 4.88$, $p < 0.00001$, two-tailed). This suggests that prior experience increases willingness or enthusiasm to integrate Serious Games in the classroom.

A similar analysis revealed a statistically significant difference in comfort levels, with experienced teachers ($M = 3.79$, $SD = 0.78$) feeling more comfortable than those without experience ($M = 2.93$, $SD = 0.97$). The mean difference was 0.86 ($t(103) = 4.90$, $p < 0.00001$, two-tailed).

Finally, regarding opposition to the use of Serious Games in classrooms, teachers with experience ($M = 1.51$, $SD = 0.91$) showed significantly less opposition than those without ($M = 2.19$, $SD = 1.00$), with a mean difference of 0.68 ($t(103) = 3.61$, $p < 0.001$). These results indicate that prior use is associated with lower opposition to implementing Serious Games in the classroom.

4.3.10. Reasons for Using Serious Games in Classroom and Prior Integration Experience

Independent samples t-test [44] was conducted to examine whether teachers' prior experience with integrating Serious Games in the classroom affects their attitudes towards the reasons for choosing to use these games. As previously mentioned, these reasons include using Serious Games as tools for motivation, collaboration, and instruction. Results are shown in Table IX.

Initially, a t-test was conducted to compare the use of Serious Games as motivational tools between teachers with and without prior classroom experience using them. Teachers with experience ($M = 4.15$, $SD = 0.67$) rated their motivational value significantly higher than those without ($M = 3.75$, $SD = 0.66$), with a mean difference of 0.40 ($t(103) = 3.09$, $p < 0.05$, two-tailed). This indicated that prior experience is associated with a stronger perception of their motivational use.

A similar analysis examined their use as tools for fostering student collaboration. Teachers with prior experience

($M = 3.90$, $SD = 0.85$) rated them higher than those without ($M = 3.59$, $SD = 0.70$), with a mean difference of 0.31 ($t(103) = 2.04$, $p < 0.05$, two-tailed), suggesting that experience also influences views on their collaborative value.

Finally, use of Serious Games as instructional tools was compared between the two groups. Teachers with prior experience ($M = 4.01$, $SD = 0.69$) rated their instructional value significantly higher than those without ($M = 3.66$, $SD = 0.65$), with a mean difference of 0.35 ($t(103) = 2.71$, $p < 0.05$, two-tailed).

4.3.11. Teachers' Concerns Towards Using Serious Games in the Classroom and Their Prior Integration Experience

Independent samples t-test [44] was also conducted to compare concerns about Serious Games between teachers with prior experience using them and those without. Teachers with experience reported significantly lower levels of concern ($M = 1.97$, $SD = 0.44$) compared to those without experience ($M = 2.30$, $SD = 0.45$), with a mean difference of 0.33 ($t(103) = -3.82$, $p < 0.05$, two-tailed). These results indicate that prior use is associated with reduced concerns regarding the implementation of Serious Games in classrooms.

4.3.12. Benefits of Using Serious Games in Classroom and Prior Integration Experience

Finally, an independent samples t-test [44] was conducted to examine whether teachers' perceptions of the benefits of Serious Games are influenced by prior experience with their use in the classroom. Teachers with experience reported more favourable perceptions ($M = 4.05$, $SD = 0.69$) than those without ($M = 3.73$, $SD = 0.86$), with a mean difference of 0.32 ($t(103) = 2.07$, $p < 0.05$, two-tailed). These findings suggest that prior use is associated with more positive perceptions towards benefits of Serious Games.

5. CONCLUSION

This study, conducted via an online questionnaire, focused on secondary education teachers in Greece. The focus of the study was the examination of their use of Serious Games in classroom, their attitudes towards them, and how prior experience influences those attitudes.

The sample appears representative of the population, based on demographic data. Most participants were aged 50 and above, which aligns with findings from Lakasas [41], reporting that the majority of active secondary education teachers in Greece fall within this age group [41]. Additionally, 78.1% of respondents were women, consistent with UNESCO data indicating that women make up 63.4% of

the country's secondary educators [45]. Notably, 70.5% had over 15 years of teaching experience, which likely influences their perspectives on the use of Serious Games.

Participating teachers were introduced to the term “serious games” at both the start and midpoint of the questionnaire. Most participants were unfamiliar with the term “serious games” prior to the survey and felt more comfortable with the term “digital educational games”. This unfamiliarity is consistent with the study by Ouahbi *et al.* [38], where all participating teachers reported no prior knowledge of the term. A clear definition was therefore essential to ensure reliable results.

Reported use of Serious Games was moderate-only 44.8% of participants had used them. This percentage is relatively low compared to 83.6% reported in a study of Greek primary school teachers by Megagianni and Kakana [30], but higher than the 25.3% found in a Malaysian university context by Noraddin and Kian [34]. Due to limited research specifically on secondary education teachers in Greece, direct comparisons pose a challenge.

Teachers' attitudes towards Serious Games were generally positive. Most expressed interest in using the but felt some discomfort, likely stemming from a lack of training and familiarity. Motivation was the most frequently cited reason for use, followed by instructional use and the promotion of student collaboration. Teachers highly rated benefits such as increased engagement, development of modern skills, simulation of creativity, and support learning. While concerns were minimal, some teachers noted issues like digital exclusion and the need for careful application.

T-test analyses showed that previous experience with Serious Games significantly influenced teachers' attitudes, perceptions, and recognition of both benefits and challenges. Similar findings were reported by Megagianni and Kakana [30], where even limited use positively affected attitudes. These results underscore the importance of offering teachers' opportunities for hands-on experience and targeted training.

This study faced some limitations. The literature review was constrained by limited access to certain recent sources, which, in some cases, necessitated reliance on older publications. Survey participation was also impacted by the timing of national examinations, making it difficult to reach a larger number of available and willing teachers. Additionally, the lack of similar studies in Greece made it harder to compare and interpret the findings in a local context.

In future research, this comparison between the two groups of secondary education teachers could be conducted through practical implementation in classroom environments, enabling a more comprehensive examination of changes in teachers' attitudes and behaviours over time. Additionally, teachers could be involved in the design process of Serious Games, as was done in the study by An and Cao [39], where the results indicated a significant improvement in teachers' attitudes following their engagement in the process. Comparative studies across different regions or school types within Greece could also highlight contextual factors influencing adoption of these games

and teachers' attitudes. Investigating students' perspectives and learning outcomes would also enrich understanding of the educational value of Serious Games. By exploring these avenues, future research can provide more definitive and practical insights regarding the use of Serious Games in Greek secondary education.

ACKNOWLEDGMENT

The financial support of the European Union and Greece (Partnership Agreement for the Development Framework 2021–2027) under the Regional Operational Programme Ionian Islands 2021–2027 for the project “CuratorX” is gratefully acknowledged.

CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

REFERENCES

- [1] Rokošný I. Digital games as a cultural phenomenon: a brief history and current state. *Acta Ludologica*. 2018;1(2):48–61.
- [2] Esposito N. A short and simple definition of what a videogame is. *Proceedings of the DiGRA Conference: Changing Views: Worlds in Play; 2005 June 16-20*. Vancouver, British Columbia, Canada: DiGRA, 2005.
- [3] Caserman P, Hoffmann K, Müller P, Schaub M, Straßburg K, Wiemeyer J, *et al.* Quality criteria for serious games: serious part, game part, and balance. *JMIR Serious Games*. 2020;8(3):e19037. doi: 10.2196/19037.
- [4] Laamarti F, Eid M, El Saddik A. An overview of serious games. *Int J Comput Games Technol*. 2014;2014(1):358152. doi: 10.1155/2014/358152.
- [5] Abt CC. *Serious Games*. University Press of America; 1987.
- [6] Jean G. America's army: game branches out into real combat training. *Nat Defence*. 2006;90(627):34–6.
- [7] Bar-El D, Ringland KE. Crafting game-based learning: an analysis of lessons for Minecraft Education Edition. *Proceedings of the 15th International Conference on the Foundations of Digital Games; 2020 Sep 15–18; Bugibba, Malta*, pp. 1–4, New York: ACM, 2020. doi: 10.1145/3402942.3409788.
- [8] Pandian GSDB, Jain A, Raza Q, Sahu KK. Digital health interventions (DHI) for the treatment of attention deficit hyperactivity disorder (ADHD) in children: a comparative review of literature among various treatment and DHI. *Psychiatry Res*. 2021;297:113742. doi: 10.1016/j.psychres.2021.113742.
- [9] Yedri OB, El Aachak L, Belahbib A, Zili H, Bouhorma M. Motivation analysis process as service applied on serious games. *iJIST*. 2018;2(1):4–11. doi: 10.57675/IMIST.PRSM/ijist-v2i1.27.
- [10] Breuer J, Bente G. Why so serious? On the relation of serious games and learning. *Eludamos: J Comput Game Cult*. 2010;4(1):7–24. doi: 10.7557/23.6111.
- [11] Göbel S. Serious games application examples. In *Serious Games*. Dörner R, Göbel S, Effelsberg W, Wiemeyer J Ed. Cham: Springer, 2016. pp. 319–405. doi: 10.1007/978-3-319-40612-1_12.
- [12] Ricciardi F, De Paolis LT. A comprehensive review of serious games in health professions. *Int J Comput Games Technol*. 2014;2014(1):787968. doi: 10.1155/2014/787968.
- [13] Donovan L. *The Use of Serious Games in the Corporate Sector: A State of the Art Report*. Dublin: Learnovate Centre; 2012. doi: 10.13140/RG.2.2.22448.28169.
- [14] Yildirim S. Serious game design for military training. *Proceedings of Games: Design and Research Conference*, pp. 3–4, Volda University College, 2001 Jun 3.
- [15] Mortara M, Catalano CE, Bellotti F, Fiucci G, Houry-Panchetti M, Petridis P. Learning cultural heritage by serious games. *J Cult Herit*. 2014;15(3):318–25. doi: 10.1016/j.culher.2013.04.004.
- [16] Anastasiadis T, Lampropoulos G, Siakas K. Digital game-based learning and serious games in education. *IJASRE*. 2018;4(12):139–44. doi: 10.31695/IJASRE.2018.33016.

- [17] Perrotta C, Featherstone G, Aston H, Houghton E. *Game-Based Learning: Latest Evidence and Future Directions*. Slough: NFER; 2013.
- [18] Zhonggen Y. A meta-analysis of use of serious games in education over a decade. *Int J Comput. Games Technol*. 2019;2019(1):4797032. doi: 10.1155/2019/4797032.
- [19] Leitner M, Greenwald E, Montgomery R, Wang N. Design and evaluation of ARIN-561: an educational game for youth artificial intelligence education. *Proceedings of the 30th International Conference on Computers in Education*, 2022 Jan.
- [20] Katsaounidou A, Vrysis L, Kotsakis R, Dimoulas C, Veglis A. MATHe the game: a serious game for education and training in news verification. *Educ Sci*. 2019;9(2):155. doi: 10.3390/educsci9020155.
- [21] Locke EA, Schattke K. Intrinsic and extrinsic motivation: time for expansion and clarification. *Motiv Sci*. 2019;5(4):277–90. doi: 10.1037/mot0000116.
- [22] Drummond D, Hadchouel A, Tesnière A. Serious games for health: three steps forwards. *Adv Simul*. 2017;2(1):3. doi: 10.1186/s41077-017-0036-3.
- [23] Pange J, Lekka A, Katsigianni S. Serious games and motivation. In *Interactive Mobile Communication Technologies and Learning*. Auer ME, Tsiatsos T Ed. Cham: Springer International Publishing, 2018. pp. 240–6. doi: 10.1007/978-3-319-75175-7_25.
- [24] Csikszentmihalyi M, Abuhamdeh S, Nakamura J. Flow, Flow and the foundations of positive psychology: the collected works of Mihaly Csikszentmihalyi. In Csikszentmihalyi M Ed. Dordrecht: Springer, 2014. pp. 227–38. doi: 10.1007/978-94-017-9088-8_15.
- [25] Nakamura J, Csikszentmihalyi M. The concept of flow. In *Flow and the Foundations of Positive Psychology: The Collected Works of Mihaly Csikszentmihalyi*. Csikszentmihalyi M Ed. Dordrecht: Springer, 2014. pp. 239–63. doi: 10.1007/978-94-017-9088-8_16.
- [26] Denney AS, Tewksbury R. How to write a literature review. *J Crim Justice Educ*. 2013;24(2):218–34. doi: 10.1080/10511253.2012.730617.
- [27] Van Wee B, Banister D. How to write a literature review paper? *Transp Rev*. 2016;36(2):278–88. doi: 10.1080/01441647.2015.1065456.
- [28] Pinnikas N. Teacher attitudes and reflections on COTS and Serious Games in education [master's thesis]. Rhodes: University of the Aegean; 2021. 109p. Πιννίκας Ν. COTS and serious games στην εκπαίδευση: απόψεις και προβληματισμοί των εκπαιδευτικών [μεταπτυχιακή διατριβή]. Ρόδος: Πανεπιστήμιο Αιγαίου; 2021. 109σ. Greek.
- [29] Alexandri A. Cultural perceptions of secondary education teachers regarding information and communication technologies [PhD thesis]. Agrinio; University of Patras; 2020. 397p. doi: 10.12681/eadd/47208. Αλεξανδρή Α. Πολιτισμικές αντιλήψεις εκπαιδευτικών δευτεροβάθμιας εκπαίδευσης για τις τεχνολογίες πληροφορίας και επικοινωνιών [διδακτορική διατριβή]. Αγρίνιο; Πανεπιστήμιο Πατρών; 2020. 397σ. doi: 10.12681/eadd/47208. Greek.
- [30] Megagianni P, Kakana D. The educational value and impact of serious games in cognitive, social and emotional development in middle childhood: perceptions of teachers in Greece. In *The Educational Value and Impact of Serious Games in Cognitive, Social and Emotional Development in Middle Childhood: Perceptions of Teachers in Greece*. Tsiatsos T, Demetriadis S, Mikropoulos A, Dagdilelis V Eds. Cham: Springer International Publishing, 2021. pp. 129–45. doi: 10.1007/978-3-030-64363-8_8.
- [31] Taherdoost H. A guide to evaluate academic sources to develop research paper: source selection in academic writing. *Asian Rev Soc Sci*. 2022;11(1):54–8. doi: 10.51983/arss-2022.11.1.3085.
- [32] Clark University. *Academic Success and Personal Growth Tutorials* [Internet]. Worcester (MA): Clark University Libraries; [updated 2025 Sep 26; cited 2025 Apr 20].
- [33] Cheung AK-L. Structured questionnaires. In *Encyclopedia of Quality of Life and Well-being Research*. Michalos AC Ed. Dordrecht: Springer; 2021. pp. 6399–402.
- [34] Noraddin E, Kian NT. Three learning potentials in digital games: perception of Malaysian university teachers. *J E-Learn Knowl Soc*. 2015;11(3):142–60.
- [35] Son J-B, Park S-S, Park M. Digital literacy of language learners in two different contexts. *ALT CALL J*. 2017;13(2):77–96. doi: 10.29140/jaltcall.v13n2.j213.
- [36] Zafeiropoulos K. How to conduct a scientific paper [Internet]. Athens: Kritiki; 2015 [cited 2025 Apr 21]. Ζαφειρόπουλος Κ. Πώς γίνεται μια επιστημονική εργασία [Internet]. Αθήνα: κριτική; 2025 [cited 2025 Apr 21]. Available from: <https://kritiki.gr/product/pos-ginete-mia-epistimoniki-ergasia/>. Greek.
- [37] Assaf M, van Hillegersberg J, Spil T, Arikat N. Teachers' perceptions about using serious games in formal education in Jordan: possibilities and limitations. *Proceedings of 2019 IEEE Global Engineering Education Conference (EDUCON)*, pp. 436–41, Dubai, United Arab Emirates: IEEE, 2019. doi: 10.1109/EDUCON.2019.8725193.
- [38] Ouahbi I, Darhmaoui H, Kaddari F, Elachqar A, Lahmine S. Pre-service teachers' perceptions and awareness toward serious games in the classroom: case of Morocco. *Proceedings of 13th International Conference on Computer Graphics, Imaging and Visualization (CGiV)*; 2016 Mar 29; Beni Mellal, Morocco, pp. 431–6, Morocco: IEEE, 2016. doi: 10.1109/CGiV.2016.89.
- [39] An Y-J, Cao L. The effects of game design experience on teachers' attitudes and perceptions regarding the use of digital games in the classroom. *TechTrends*. 2017;61(2):162–70. doi: 10.1007/s11528-016-0122-8.
- [40] Athanasopoulos CH. Study of teachers' views on the use of digital educational games (serious games) in primary education [master's thesis]. University of Patras; 2018. Αθανασόπουλος Χ. Μελέτη των απόψεων των εκπαιδευτικών σχετικά με τη χρήση ψηφιακών εκπαιδευτικών παιχνιδιών (serious games) στην πρωτοβάθμια εκπαίδευση [μεταπτυχιακή διατριβή]. Πανεπιστήμιο Πατρών; 2018. Greek.
- [41] Lakasas A. *Aging teachers pose challenge to Greek schools* [Internet]. Athens: eKathimerini; 2024 Oct 22 [cited 2025 May 18]. Available from: <https://www.ekathimerini.com/news/1251510/aging-teachers-pose-challenge-to-greek-schools/>.
- [42] Prensky M. Digital natives, digital immigrants. *On the Horizon*. 2001;9(5):1–6. doi: 10.1108/10748120110424816.
- [43] Franke TM, Ho T, Christie CA. The chi-square test: often used and more often misinterpreted. *Am J Eval*. 2012;33(3):448–58. doi: 10.1177/1098214011426594.
- [44] Mishra P, Singh U, Pandey CM, Mishra P, Pandey G. Application of student's t-test, analysis of variance, and covariance. *Ann Card Anaesth*. 2019;22(4):407–11.
- [45] World Bank. *Secondary Education, Teachers (% Female)* [Internet]. Washington, DC: World Bank; 2025 [cited 2025 May 20]. Available from: <https://data.worldbank.org/indicator/SE.SEC.TCHR.FE.ZS>.